

"1850, March 11. Broad and bright, but ill defined, and I think, patchy, zodiacal light, extending to the *Pleiades*.

"1850, Dec. 23. Between 7^h 30^m and 8^h p.m., there was much diffused light along the west horizon, extending from the setting of the galaxy 40° or 50° towards the south. It had not at all the appearance of the aurora borealis, but much more the aspect of another form of zodiacal light, a faint beam of which seemed to stream upwards through the region of ζ *Aquarii* towards *Saturn*. It struck me as being very probably a greatly foreshortened projection of this light, which, if this is the case, will shortly become visible in its lenticular form.

"1852, Jan. 17. As twilight disappeared, the zodiacal light began to be visible; fainter than the galaxy, but extending beneath and beyond the stars of *Pegasus*, and nearly as far as *Aries*; its edges and termination were, however, exceedingly ill defined. A suspicion was entertained that it consisted of several separate, though not distinct, streams. Later, perhaps about 6^h 30^m, its lower and broader part was very conspicuous, twilight having now disappeared, and it there seemed to be much brighter than the Milky Way. Its further condition could not be observed.

"1853, Feb. 26. The zodiacal light was beautifully seen at and after 7^h 45^m. It appeared as a pillar of diffused light, extending beyond the stars of *Aries*, but very ill defined at its sides and termination. It did not appear, at first, to be much inclined to the horizon; as it sank lower, it was fancied to be more so. Its centre appeared more luminous than its edges, and far brighter than any visible portion of the galaxy, so as to be a conspicuous object.

"March 8. The zodiacal light was again very splendid about 7^h 45^m. A tapering prolongation appeared to the averted eye to extend nearly to the *Pleiades*.

"*Tretire*, Dec. 28, 1853."

On a newly-invented Portable Equatoreal. By Mr. William Rothwell.

This instrument consists of a telescope 14 inches in length, carrying the hour-circle at the eye-end, and turning on cylindrical collars in uprights securely fixed to a brass pillar attached to an horizontal plate, so that the telescope, which is the polar axis, has an inclination equal to the latitude of the place, when the plate is levelled by the three foot-screws, provided for that purpose; there is also a pair of antagonist screws which give the whole of the instrument a movement in azimuth, and serve to place the instrument upon the meridian.

Below the telescope is an horizontal axis, supported upon two uprights in the usual manner, the western pivot of which carries the declination-circle, and is furnished with a level and the usual adjustments appertaining to the finding circle of a transit instrument; this axis in rotating carries with it, directly under the telescope, a plane mirror, whose surface is adjusted parallel to the declination

axis, when its normal ought to coincide with the line of collimation of the telescope, the mode of effecting which has yet to be described. The adjustment of the line of collimation to the normal of the mirror is obtained by setting the mirror parallel to the object-glass of the telescope; then the direct rays from a lamp illuminating the wires will render their images reflected from the axis mirror visible in the field of view of the telescope, which must be made to coincide with those seen by direct vision, by means of the adjusting screws at the eye-end, in the usual manner; then reverse the axis to its Ys, and if the reflected image of the meridian wire does not coincide with that seen by direct vision, correct one-half of the difference by the collimation adjusting-screws, and the remainder by the screws at the back of the mirror (it may be observed that this adjustment, which is a permanent one, is always made by the maker of the instrument); again reverse the axis to its original position with the circle to the west, and if the coincidence of the wires be perfect, the reflecting surface will be perpendicular to the line of collimation and parallel to the horizontal axis. Therefore, if the reflecting plane be perpendicular to the line of collimation, and parallel to the horizontal axis, and also at right angles to the meridian, the axis-mirror when moved in altitude, from the horizon to the zenith, will reflect successively upon the meridian wire of the telescope all the heavenly bodies as they pass the meridian.

It is adjusted in the following manner :—

Level the base of the telescope support by means of the hanging level, which is constructed to answer both purposes.

To determine the inclination of the telescopic polar axis to the latitude, and find the horizontal point.

Elevate the telescope by raising the plate which supports it, until it is nearly horizontal; then, by placing a brass tube with adjusting steel points, provided for that purpose, into two holes, between the upper and lower brass plates, it will support the telescope in an horizontal position; apply the level to the cylindrical collars of the telescope, and if the bubble be not in the middle, screw or unscrew the steel points of the brass tube support until it be so; when the horizontal point will be obtained by direct vision; then bring the bubble of the cross level into the middle of its opening, and clamp it securely; set the declination arc to zero, and clamp it; then depress that end of the cross-level which is nearest the eye-end of the telescope, through an angle equal to the latitude of the place; remove the brass tube support and lower the plate, carrying the telescope to its original position, where it is supported at one end, on the point of an adjustable screw, firmly fixed to the lower plate; and if the cross-level of the axis be not in the middle, adjust by the screw, and the polar axis will be at an inclination equal to the latitude.

The true reflected horizontal point will be as much below that determined by direct vision as is equal to the descent of the hole in the centre of the axis, and if brought by reflection from the mirror on the horizontal wire of the telescope, the vernier set to zero, and

the cross-level clamped with its bubble in the middle, it will read altitudes: in order to read declination, elevate the mirror to the co-latitude; clamp it; set the vernier to zero, and the cross-bubble in the middle of its opening.

If the equatoreal be removed to any latitude within its limits, a revision of its adjustments will be unnecessary, as the inclination of the polar axis can be adjusted to the difference of latitude by the graduated arc at the end of the side plate, which is screwed on the moveable one.

The telescope, when in the horizontal position, can be used as a transit instrument, from the equator to within 20 degrees above the north horizon. (If the plane of the mirror be parallel to the declination axis, and perpendicular to the line of collimation, or polar axis, and the declination axis at right angles to the plane of the meridian, the polar axis will be in the last-mentioned plane), which, in equatoreals, is a desideratum.

To prove the flatness of the surface of the mirror, place it at right angles to the line of collimation, by reflection of the wires, and reverse its axis to its Ys, to verify the adjustments; then select an object in the horizon; bring it on the meridian wire; reverse the axis; and if the object be in coincidence with the wire, the mirror is a true plane.

It may be observed, in conclusion, that if the plane of the mirror be parallel to the declination axis, the axis at right angles to the line of collimation and perpendicular to the plane of the meridian, the collimation or polar axis will be in the last-mentioned plane, which, in equatoreals, is a desideratum; and that the telescope, being a fixture, the observer never changes his position in observing stars from the horizon to 20° north of the zenith.*

Stellarum Fixarum imprimis Duplicium et Multiplicium Positiones Mediæ pro Epochâ 1830.0, deductæ ex Observationibus Meridianis, annis 1822 ad 1843 in Specula Dorpatensi institutis, auctore F. G. W. Struve, fol. pp. 380 (Introduc., pp. ccliv.), Petrop. 1852.

This work, which contains the conclusion of the record of M. Struve's labours on Double Stars at Dorpat, is dedicated by the author "to the memory of the immortal individuals W. Herschel and F. W. Bessel," who contributed in so high a degree by their respective researches to the advancement of stellar astronomy.

M. Struve commences his elaborate Introduction with a brief history of his labours on double stars. When, in the year 1822, he commenced a series of observations of the places of the stars with the meridian circle of Reichenbach, the object which he had in view was twofold. In the first place, he was desirous of deducing the fundamental elements of astronomical science solely from his

* It is intended to send one of these instruments to the Apartments of the Society for the purpose of inspection.